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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference ASK072BWO	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/EP2004/006279	International filing date *(day/month/year)* 10.06.2004	Priority date *(day/month/year)* 11.06.2003
International Patent Classification (IPC) or national classification and IPC D06F33/02, D06F37/20, D06F37/30		
Applicant ASKOLL HOLDING S.R.L. et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 9 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☒	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand 03.01.2005	Date of completion of this report 28.04.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Weinberg, E Telephone No. +49 89 2399-2298

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/006279

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-11	as originally filed
Claims, Numbers	
1-15	filed with telefax on 04.04.2005
Drawings, Sheets	
1/6-6/6	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/006279

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-15
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-15
Industrial applicability (IA)	Yes:	Claims	1-15
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

1. The following documents (D) are referred to in this communication:

   D1: US 5 677 606 A
   D2: US 2002 / 0035757 A
   D3: US 6 341 507 B

2. The amendments filed with the telefax dated 04.04.2005 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.

a. According to amended claim 1, the claimed method comprises the step of "checking that said value of unbalanced mass is lower than a predetermined acceptable reference value ($\Delta(Iq1)_{AMM}$)" (claim 1, lines 14-15).

However, the application as filed discloses only that the method comprises the step of checking that **the imbalance** is lower than a predetermined acceptable reference value ($\Delta(Iq1)_{AMM}$) (see, e.g: page 10, lines 23-25). There is no explicit disclosure in the original application that **the value of unbalanced mass** is compared with a predetermined acceptable reference value.

Therefore, this amendment of claim 1 introduces which extends beyond the content of the application as filed, contrary to Art. 34(2)(b) PCT.

Consequently, for the purpose of this report, it is assumed that claim 1 comprises in fact the term "checking that said **imbalance** is lower than a predetermined acceptable reference value ($\Delta(Iq1)_{AMM}$)"

b. According to amended claim 1, the claimed method comprises the step of "adjusting the angular revolution speed of the motor in real or continuous time" (claim 1, line 20). This also comprises the option to adjust the angular revolution speed of the motor continuously.

However, the application as filed discloses only that the imbalance, i.e. the motor current variations, are continuously monitored and that the unbalanced mass is

calculated in real time (see, e.g, page 9, lines 16-23, page 10, line 30, page 11, line 6). There is no explicit disclosure in the original application that the claimed method comprises also adjusting continuously the angular revolution speed of the motor.

Further, even if the problem underlying the application is to provide, inter alia, a method allowing a "real-time intervention"; the term "real-time intervention" does not mean "adjusting continuously the angular revolution speed of the motor". Moreover, it is noted that the features of the suggested solution are normally not directly and unambiguously derivable from the statement of the problem underlying the application.

Therefore, the application as filed does not disclose neither explicitly nor implicitly that the claimed method comprises the step of "adjusting the angular revolution speed of the motor in real or continuous time" (claim 1, line 20). Consequently, this amendment extends beyond the content of the application as filed, contrary to Art. 34(2)(b) PCT.

Hence, for the purpose of this report, it is assumed that the term "in real or continuous time" in claim 1 is deleted.

3. It is noted that the following amendment of claim 1 filed with the telefax dated 04.04.2005 meets the requirements of Art. 34(2)(b) PCT:

According to amended claim 1, the claimed method comprises the step of "said current (Iq) driving as a feedback signal said motor" (claim 1, line 18). This means that the current (Iq) driving the motor is a feedback signal resulting from the preceding calculation and checking.

The application as filed discloses that the method comprises the step of "to feedback and current drive the motor" (see page 10, line 14) and of "feedback driving and adjusting of the angular revolution speed of the motor" (see page 11, lines 19-20). This means that the current driving the motor is a feedback resulting from the preceding calculation and checking.

Therefore, the application as filed discloses at least implicitly that the claimed method comprises the step of "said current (Iq) driving as a feedback signal said motor" (claim 1, line 18).

4. Not taking into considerations the above mentioned (see point 2.a. and 2.b.) amendments beyond the content of the application as filed, the subject-matter of claims 1-15 does not involve an inventive (Art. 33(3) PCT) step, for the following reasons:

The problem underling the invention is to provide "a method allowing an unbalanced mass to be detected quite precisely and rapidly in the load of the rotatable drum of a washing machine driven by a synchronous motor with a permanent magnet rotor and a real-time intervention on the synchronous motor driving in order to reduce in real time any oscillation in the bud thus fading out possible subsequent vibration of the whole washing machine structure" (page 3, lines 21-27).

a. This solution to this problem suggested by claim 1 is based on the idea that a relation exists between the load imbalance and the current absorbed by an electric motor.

Such a method addressing the problem of detecting an unbalanced condition of a rotating load based on the current absorbed by an electric motor with almost all the features of claim 1 is known in the prior art. For instance:

(i) document D1 (see D1, column 1, line 42 - column 2, line 26, figures 1-17) suggests to detect the presence of an unbalance condition of the rotatable drum of a washing machine on the basis of a standardised deviation between the instantaneous current from an predetermined value.

(ii) document D2 (see D2, paragraphs [0006] - [0011], [0024] - [0027], figures 1-5) suggests to detect and control an unbalance condition of the rotatable drum of a washing machine through measuring the "ripple" of the electric current drawn by the motor and through manipulating the current (see D2, paragraph [0034]).

However, the following differences between the subject-matter of claim 1 and the disclosure of D1 or D2 are noted:

I. The method of claim 1 is, inter alia, suitable for "detecting the unbalanced conditions of a rotating load driven by a synchronous electric motor" (claim 1, lines 2-3) while neither D1 nor D2 disclose explicitly a synchronous electric motor.

Still, the method as outlined in claim 1 is also perfectly suitable for detecting the unbalanced conditions of a rotating load driven by an induction motor through a frequency drive such as in D1 (see D1, column 5, lines 29-53) or by the "controlled induction motor" as in D2 (see D2, paragraph [0022]). Therefore, claim 1 is not explicitly restricted to synchronous motors, and, hence, extends implicitly also to other electric motors comprising means for constantly monitoring and detecting the instantaneous current absorbed by the motor, like in D1 or D2.

Further, it is obvious to the person skilled in the art, namely when the same result is to be achieved, to apply the features of D1 or D2 with corresponding effect also to a synchronous motor, like for instance to the motor of D3 (see D3, column 2, line 46 - column 3, line 25, column 5, lines 13-17, column 6, lines 3-9), considering the close relatedness of an induction motor and a synchronous motor. In particular, the person skilled in the field of electric motors suitable for washing machines is familiar with the fact that the supplied torque of a synchronous motor with permanent magnet is directly proportional to the drawn current, due to the fact that a synchronous motor follows synchronously the phases of the exciting electric field even under heavy load until failure of the motor. Therefore, although D1 or D2 disclose only induction motors, it would be an obvious and even more advantageous choice of the skilled person to apply the teaching of D1 or D2 also to a synchronous motor, thereby possibly obviating the need for measuring the speed of the motor which is required with an induction motor.

II. The method of claim 1 comprises the step of "calculating in real time the value of an unbalanced mass on the basis of the variation of said current" (see claim 1, lines 9-10).

However, the calculation of the value of the unbalanced mass is a non essential feature since the unbalance condition is detected according to claim 1 based on the variation of the absorbed current and not on the value of the unbalanced mass.
In fact, it is only checked that the imbalance measured as variation of the absorbed current is lower than a predetermined acceptable reference value (see point 2.a. above), the determination of the value of unbalanced mass is not required for detecting the unbalanced condition, at least not according to claim 1, without considering the amendments beyond the content of the application as filed.

Therefore, the solution suggested by claim 1 of the present application is obvious to the skilled person starting from D1 or D2 and in order to solve the above mentioned problem. Therefore, the subject-matter of claim 1 does not involve an inventive step in the sense of Art. 33(3) PCT, s

Further, the following reasons supporting the above grounds for the opinion are submitted:

i. D1 suggests to stop the rotating drum (see D1, column 1, lines 63-67) if the detected imbalance exceeds a predetermined acceptable reference value; stopping the rotating drum is definitely an embodiment of "slowing down the angular speed" as per claim 1, line 17.

ii. Moreover, the method of D2 comprises a step of "rapidly accelerating" the rotation of the drum of the washing machine (see D2, paragraph [0024], claim 1); this is definitely an embodiment of "providing a transient step with angular speed variation of the rotating drum" as per claim 1, lines 5-6.

b. The supplementary features introduced by dependent claims 2-15 specify minor implementation details which do not add anything of inventive significance to the subject-matter of claim 1.

The supplementary features of these claims 2, 4-15 are already known in the prior art

(see D1, figures 1-17, or D2, paragraphs [0011] - [0016], [0024] - [0026], or D3 (see D3, column 2, line 46 - column 3, line 25, column 5, lines 13-17) or relate only to a slight procedural change in the method of claim 1 which comes within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can readily be foreseen. In particular, the combination of these features with the method of independent claim 1 amounts merely in the juxta-position or association of known features functioning in their normal way and not producing any non-obvious working inter-relationship (see PCT Guidelines, 13.14(c)) therefore not involving an inventive step. Hence, the subject-matter of these claims does not meet the requirements of Art. 33(3) PCT.

5. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the D2 is not mentioned in the description.

CLAIMS

1. Method for detecting unbalanced conditions of a rotating load driven by a synchronous electric motor (3) in washing machines (1) and similar household appliances including a rotably drum (2) and wherein at least a transient step is provided with angular speed (w) variation of the rotably drum (2), characterised by the following steps:

- constantly monitoring and detecting the instantaneous current (Iq) absorbed by the motor;

- calculating in real time the value of an unbalanced mass (m) on the basis of the variation (Λ) of said current (Iq) and starting from a predetermined reference obtained by experimental results and by applying a calculation formula representative of the kind of load imbalance;

- checking that said value of unbalanced mass is lower than a predetermined acceptable reference value ($\Delta(Iq1)_{AMM}$) and slowing down the angular speed (w) of said drum in case of negative result;

- said current (Iq) driving as a feedback signal said motor (3) according to said value of unbalanced mass (m) adjusting the angular revolution speed of the motor in real or continuous time.

2. Method according to claim 1, characterised in that it provides a comparison between the standard deviation (σ) of said current (Iq) with a predetermined reference stored in a memory unit including for example an average value of this current (Iq) or a predetermined threshold value.

3. Method according to claim 1, characterised in that the imbalance signal is computed as a difference between the last sampled value of the current signal (Iq), in the time instant wherein the absolute value of the first derivate of said current signal (Iq) is minor than a predetermined threshold and the second derivate of the same signal Iq is positive, and

the last sampled value of said current signal (Iq) in the time instant wherein the absolute value of the first derivate of said current signal (Iq) is minor than a predetermined threshold and the second derivate of the same signal Iq is negative

4. Method according to claim 1, characterised in that the measure of said unbalanced mass (m) occurs at first by measuring said current (Iq) variation (Δ) with a low number of drum revolutions.

5. Method according to claim 4, characterised in that said low number of revolutions is comprised between 60 and 80 revolutions per minute.

6. Method according to claim 4, characterised in that it provides a step for controlling that the measured variation ($\Delta(Iq_1)$) at a low number of revolutions is lower than a predetermined acceptable reference value ($\Delta(Iq_1)_{AMM}$) and a subsequent order of slowing down the drum rotation speed (w) if this check gives a negative result.

7. Method according to claim 4, characterised in that it provides a step for controlling that the measured variation ($\Delta(Iq_1)$) at a low number of revolutions is lower than a predetermined acceptable reference value and a subsequent order of gradually increasing the drum revolving speed (w) if the control gives a positive result.

8. Method according to claim 7, characterised in that the gradual speed increase continues until about 150 revolutions per minute are reached.

9. Method according to claim 7, characterised in that it provides a step of further controlling that the measured variation ($\Delta(Iq_2)$) at increased number of revolutions is lower than a second predetermined acceptable reference value ($\Delta(Iq_2)_{AMM}$).

10. Method according to claim 9, characterised in that it provides a centrifugal step at reduced rotation speed if said further control gives a negative result.

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11. Method according to claim 9, characterised in that it provides that a centrifugal step is started if said further control gives a positive result.

12. Method according to claim 9, characterised in that it provides a slow down, without stop, of the drum (2) rotation speed in order to cause a new load distribution if said further control gives a positive result.

13. Method according to claim 10, characterised in that it provides a steady monitoring of said measured variation ($\Delta(Iq_2)$) in the centrifugal step at reduced speed.

14. Method according to claim 2, characterised in that the comparison between the variation (Δ) and said current (Iq) occurs both in static unbalanced conditions and in dynamic unbalanced conditions.

15. Method according to claim 14, characterised in that the one variation operator is the standard deviation operator (σ) and is drawn, for a dynamic imbalance, from the following relation:

$$\sigma(Iq)\text{dynamic} = m * K2 * w^{\alpha} + Ko$$

Where: Ko, K2 and α are known constant experimentally-determined values, w is the rotation speed and m is said unbalanced mass.

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AMENDED SHEET